

Atmospheric Processing Platform

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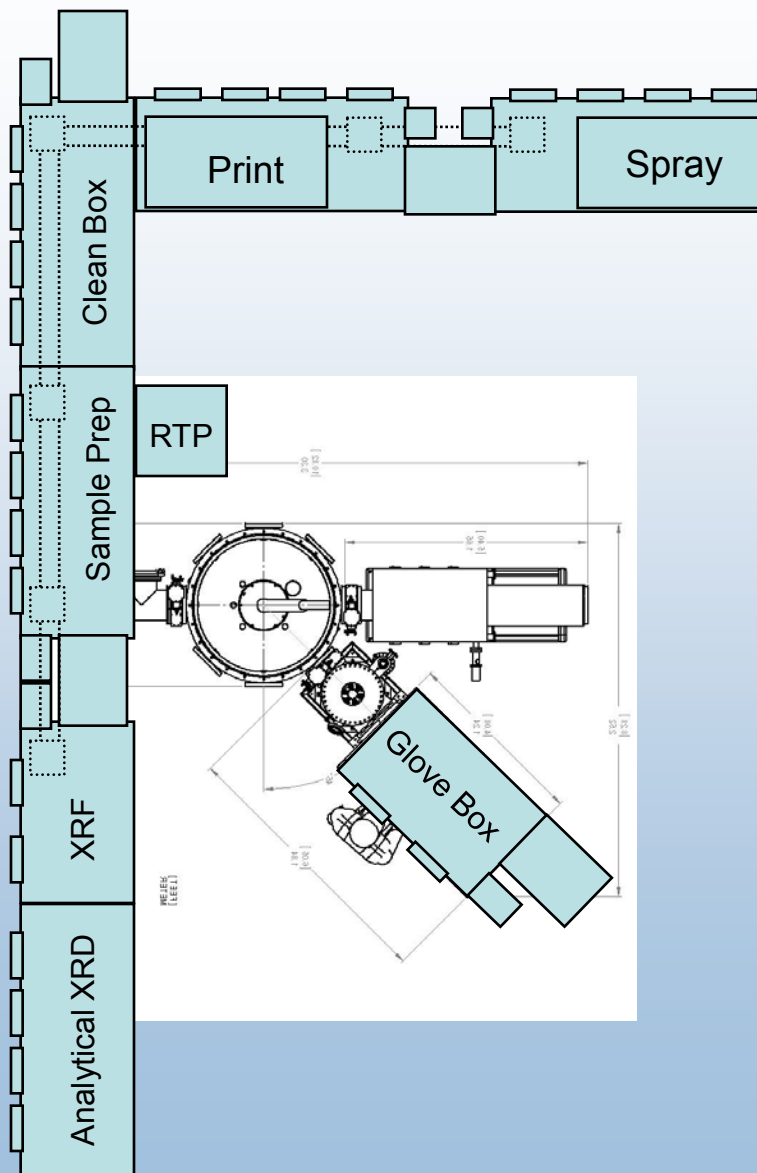
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NREL/PR-520-43170

Presented at the Solar Energy Technologies Program (SETP) Annual Program Review Meeting held
April 22-24, 2008 in Austin, Texas

Atmospheric Processing Platform



6"x6" substrates

Inkjet deposition

Spray deposition

Sputter deposition

Evaporation

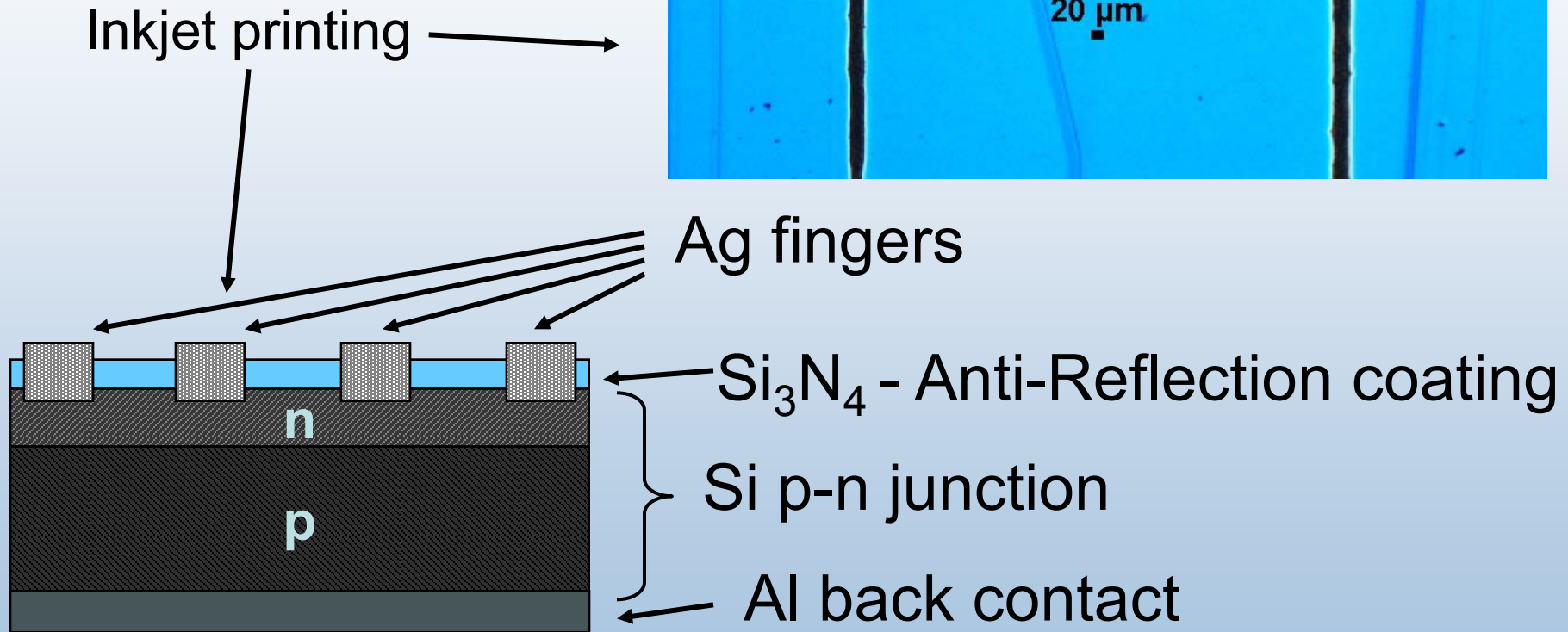
Rapid thermal
processing

XRD analysis

XRF analysis

Atmospheric processing in PV

Wafer-Silicon

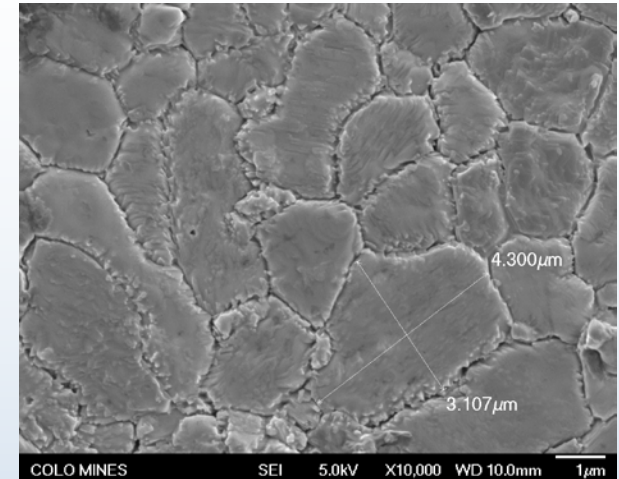
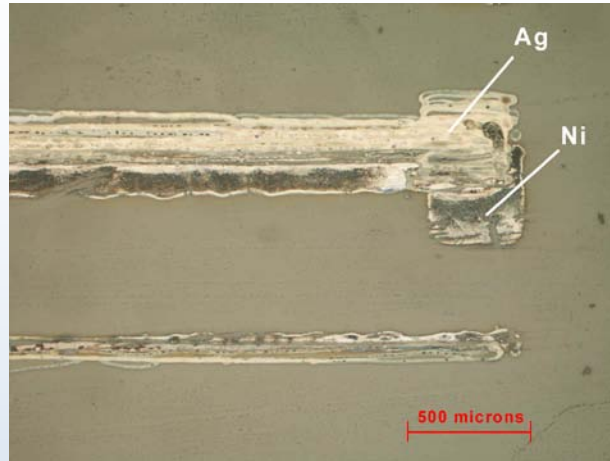


Also: Printing of dopants to form junction

Atmospheric processing in PV

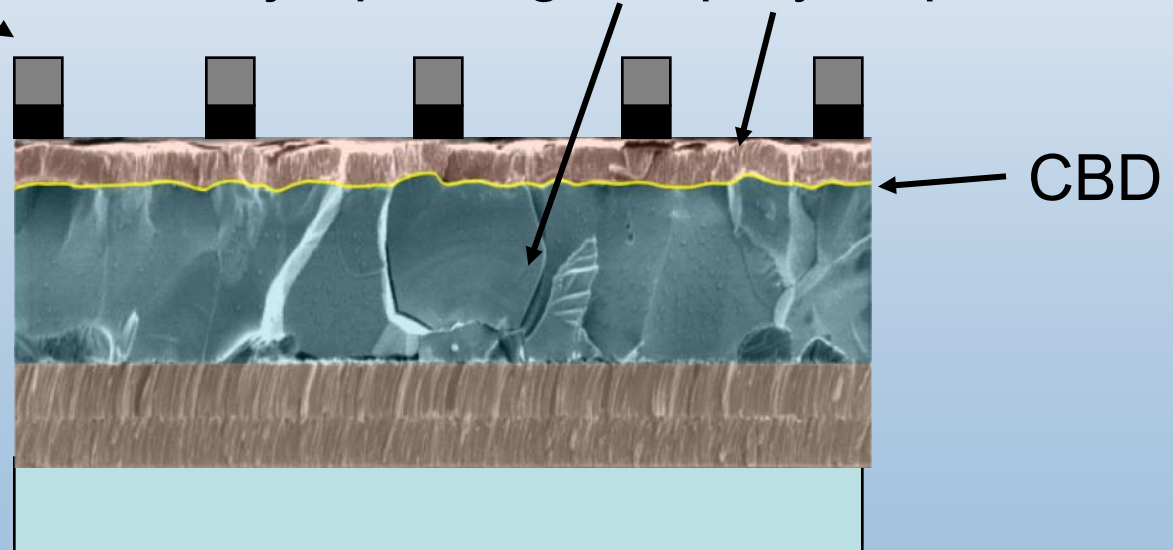
CIGS

Inkjet printing



Ni/Ag contact grid
ZnO (TCO) / CdS
CIGS absorber layer
Mo back contact
Glass substrate

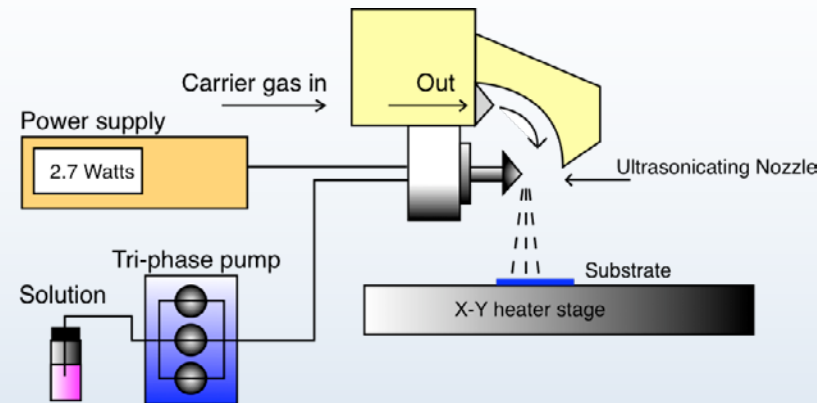
Inkjet printing or Spray Deposition



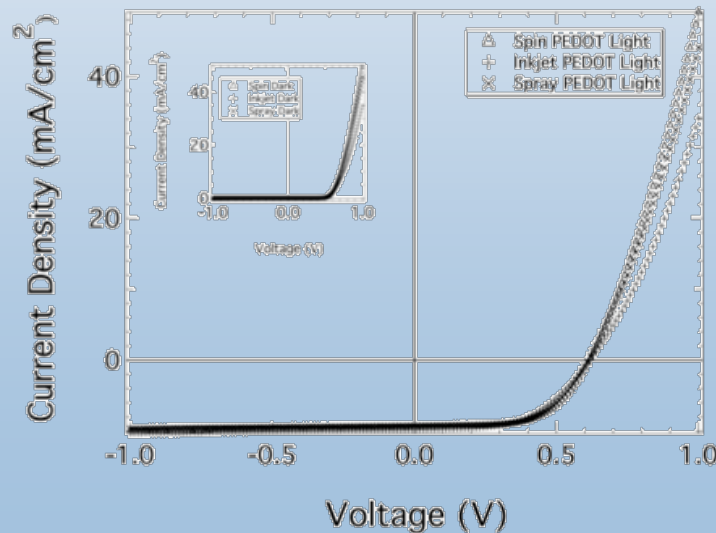
Atmospheric processing in PV

OPV

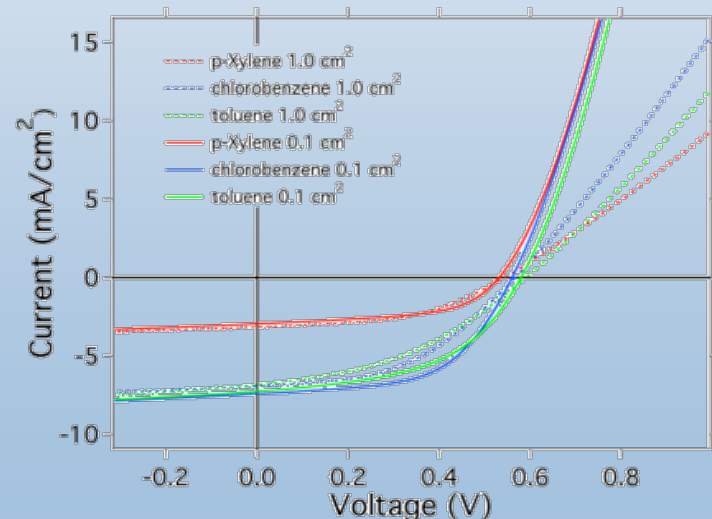
- Inkjet and ultrasonic spray produce devices comparable to spin coated for both the HIL and the absorber.
- Devices scale up in air to 1 cm² with efficiency greater than >2%
 - Setting up deposition system in glove box for increased device performance



PEDOT:PSS Deposition



Active Layer Deposition



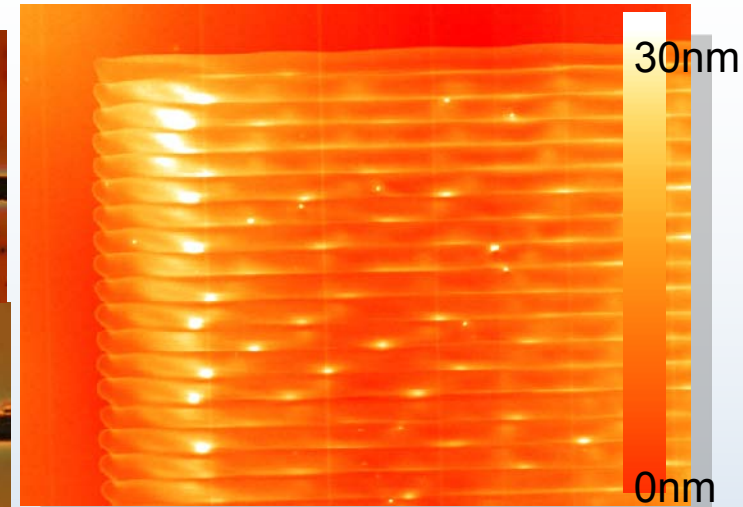
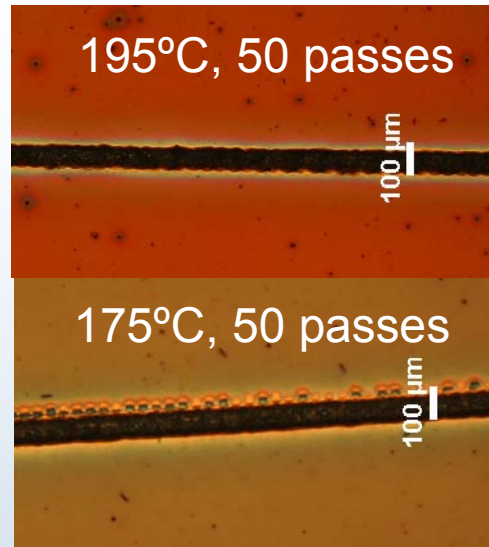
Also....

- OPV

Sprayed or printed:

- hole blocking layer
- absorber

Printed contacts



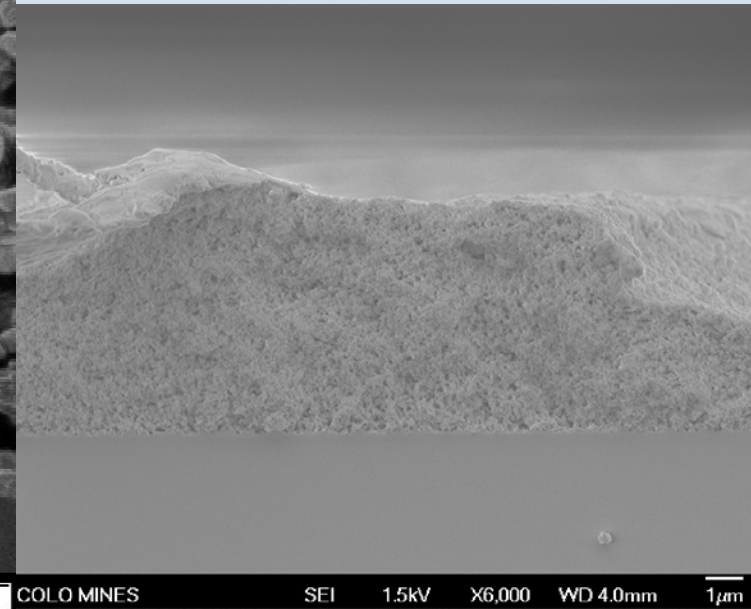
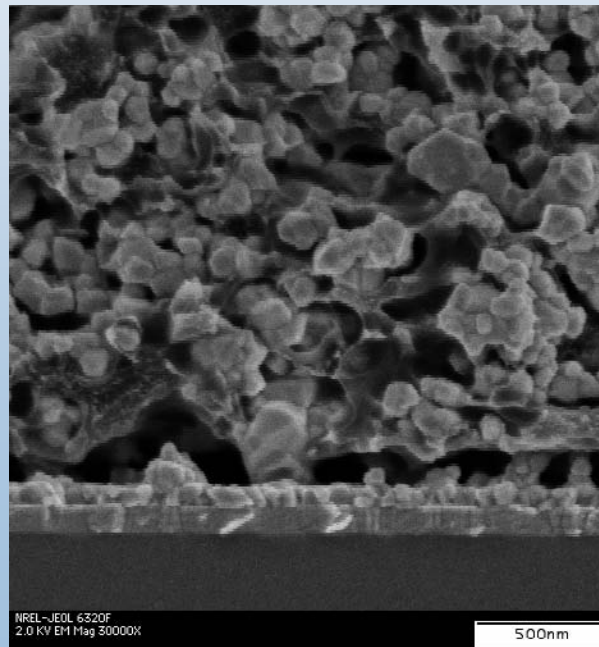
Printed PEDOT:PSS

- CdTe

Sprayed Absorber

CBD CdS

Sprayed Contacts



- And more...

NREL-JEOL 6320F
2.0 kV EM Mag 30000X

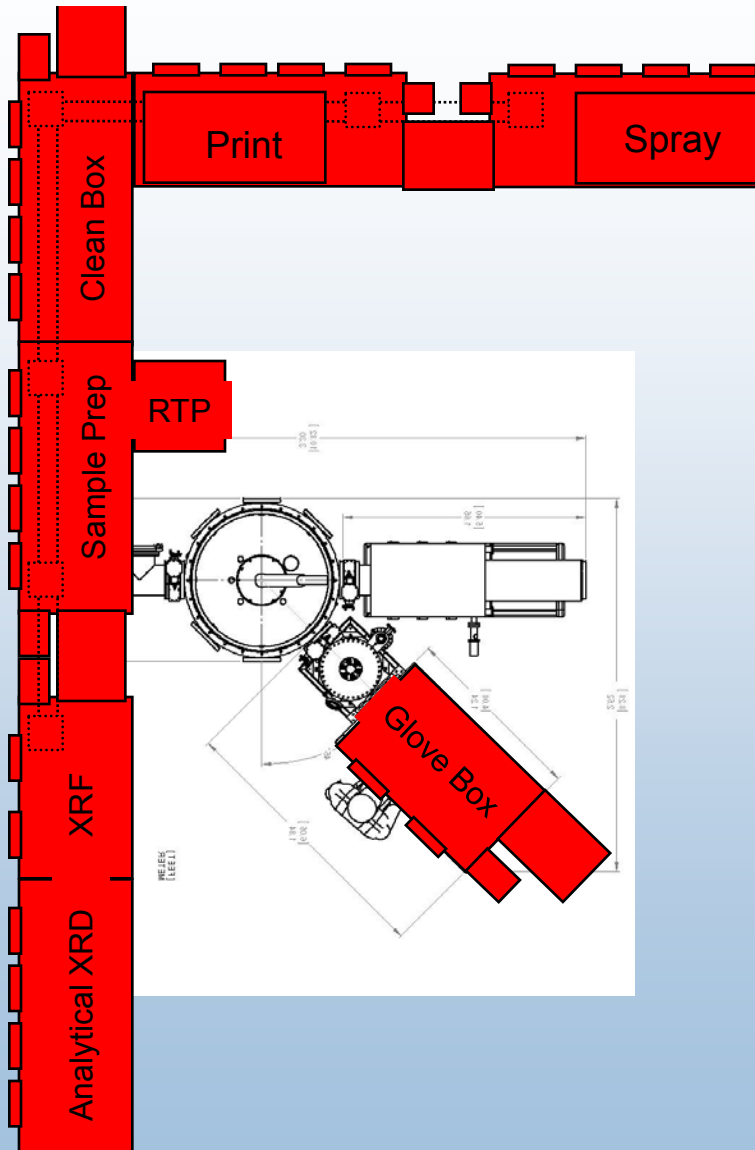
COLO MINES



SEI 1.5kV X6,000 WD 4.0mm

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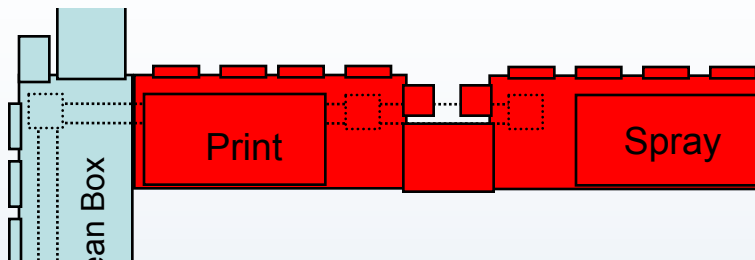
Glovebox system



Custom Gloveboxes by Mbraun

Linear motion system for sample transport between boxes

Inkjet and Spray



Custom inkjet and spray
system by iTi

Build into glovebox

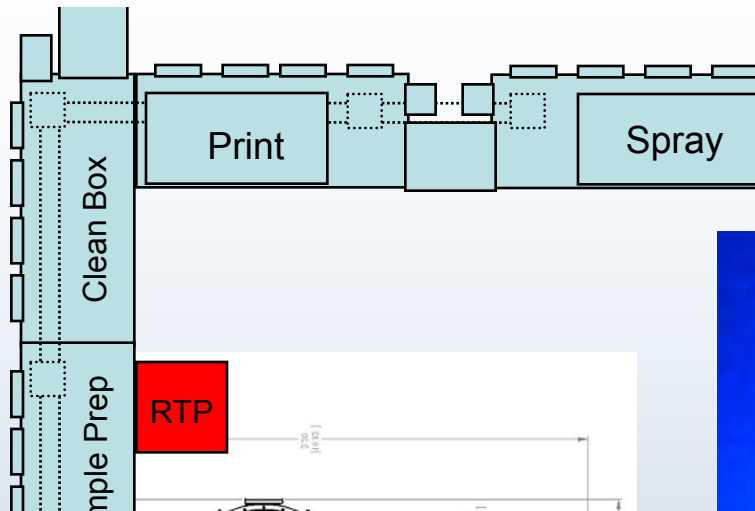
Universal X-Y platform

Multihead inkjet system

Multihead spray system

Systems
interchangeable

Rapid Thermal Processing

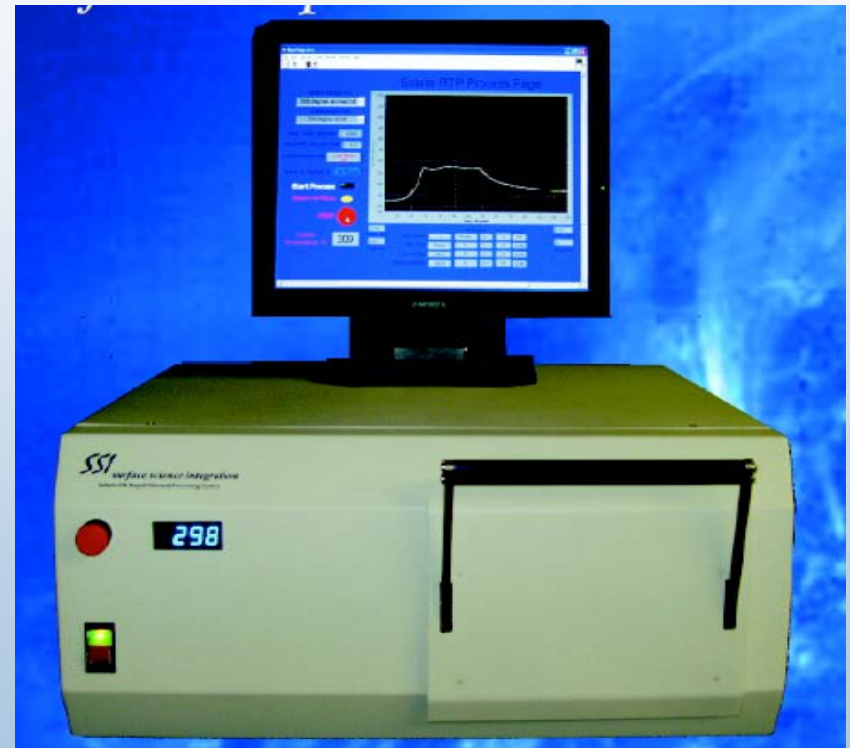


RTP by Surface Science
Integration

Build into glovebox

Up to 1250°C @ 150°C/s

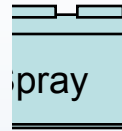
3 process gasses



XRD and XRF

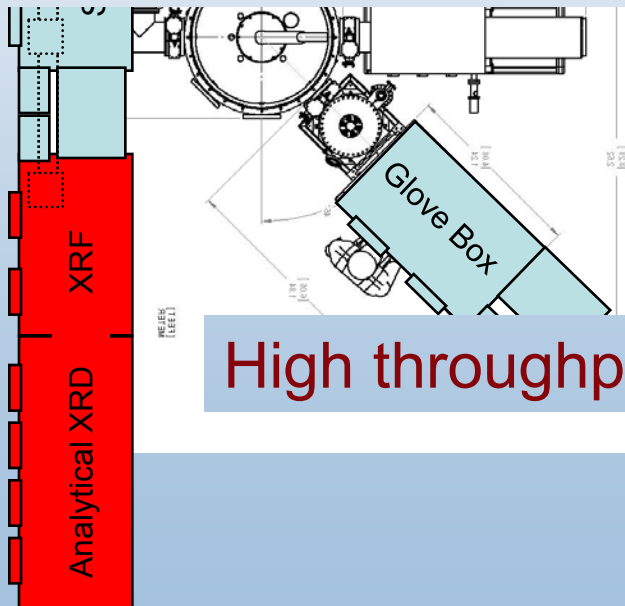
Compositional Analysis

XRF by Matrix Metrologies



Structural Analysis

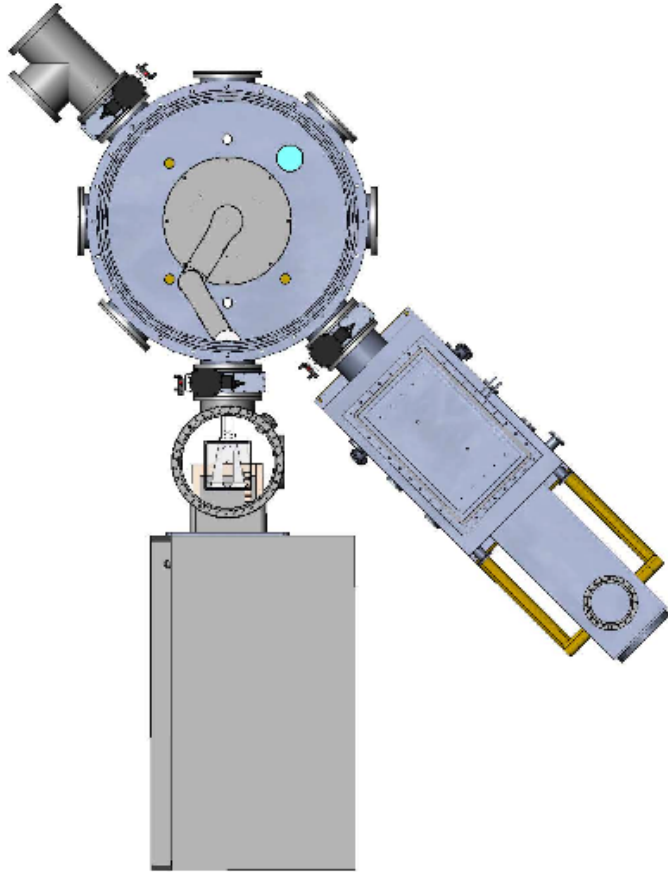
XRD by Bruker



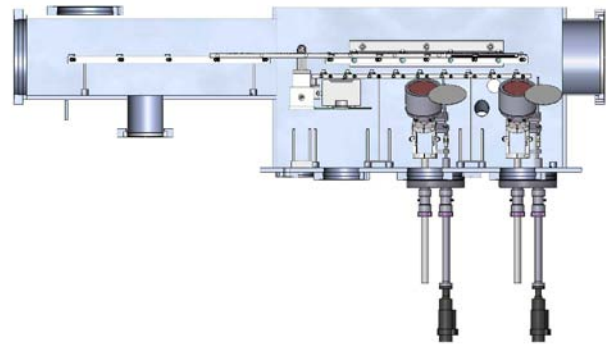
High throughput analysis



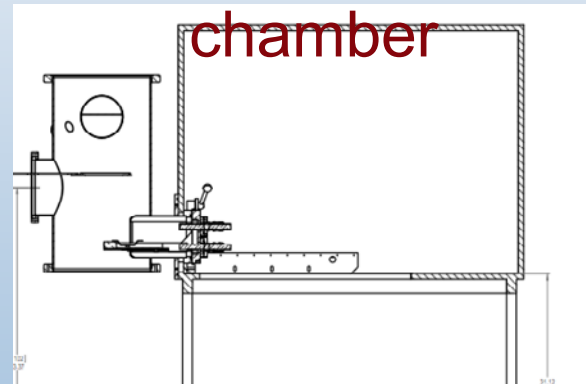
Vacuum Cluster



Cluster and chambers by
MVSystems



Multi source sputter
chamber



Multi source evaporator
with glovebox access for
air sensitive materials

Atmospheric Processing Platform

- All major component have been ordered
- Estimated delivery major components: September-November
- Partial operation:
 - Glovebox system: November
 - RTP: November
 - Inkjet + Spray: December
 - XRD + XRF: December
 - Sputter + Evaporator: January 2009
- Full integrated operation: February 2009
- Interest from industry:
 - All current CRADA partners
 - Many others in all areas

M&C PDIL Capabilities

Pete Sheldon



Platform	PV Technology Road Maps						
	Wafer Si	Film Si	CPV	CdTe	CIGS	OPV	DSPV
Thin Si							
Wafer Rep.							
CIGS							
CdTe							
Atm. Proc.							
M&C Ind.							
M&C Cluster							